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SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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May 12, 1928

LOUIS AGASSIZ, NATURALIST

Now in Hall of Fame

(See page 295)

Vol. XIII No. 370

Green Ray Seen From Ship

Physics

Intending voyagers to Europe during the next few months should carefully watch the setting sun, and they may be able to see the "green ray." This is the brilliant green coloration that the sun assumes just before its last narrow sliver disappears behind the horizon. A really satisfactory sight of it is rather rare, said Prof. R. W. Wood, professor of experimental physics at Johns Hopkins University. On thirty crossings of the Atlantic he has looked for it every time there was a clear sky, and no haze or clouds near the horizon at sunset, but has only seen it three or four times. Only once, he said, was it really striking. At that time it appeared a brilliant emerald green, about the color of a railroad signal.

The cause of the green ray is generally supposed to be that the rays of light are bent as if by a prism when they pass through the atmosphere of the earth. This enables us to see the sun for a short time after it is below the line of the horizon. As the red and orange rays are bent least, they disappear first behind the horizon. This leaves the green, blue, and violet rays still visible. Blue and violet affect the eye much less strongly than green, and so the green color predominates.

Dr. Wood accepts this theory of the origin of the ray, but proposes a new theory to explain why it is not always seen at sunset. At the time that he saw the ray so well, the air and ocean were at approximately the same temperature. Through the rest of the voyage, when it was not seen, the ocean was much warmer than the air. He thinks that when the water is warm and the air cool, the layer of warm air right in contact with the sea would cause the light rays of all colors to be bent less, and so the sun would set abnormally early. When the air is warmer than the water, the curvature of all the rays would be increased, and so the atmospheric dispersion that causes the ray would have a longer time to act.

Anyone seeing the ray from the ocean is requested to send an account of his observation, and the ocean and air temperature at the time, to Prof. Wood in Baltimore.

Science News-Letter, May 12, 1928

Fish Models Now Made

Ichthyology

Museum specimens of fish can be prepared in such a way as to be as bright and interesting and attractive as the mounted animals or birds, instead of the bleached and disappointing things they usually are in their jars of alcohol, according to the claims of M. Schelenz, a preparator at the Carlsruhe Museum, writing in the German scientific journal *Naturforscher*.

In Herr Schelenz's method, one side of a freshly killed fish is carefully cleaned of its coat of mucus, or slime. The specimen is then imbedded in modeling clay, leaving the cleaned side projecting. Then melted paraffin is poured over it forming a solid block and impregnating the fish with the wax.

The paraffined fish is next removed, leaving an exact mould of itself in the clay. Into this mould fine plaster-of-paris is poured and is allowed to harden. Then the clay is dissolved away, and the plaster cast of the fish remains, with every detail of skin and scale and fin exactly as it was in nature.

The last task is one for the artist. He takes the white plaster model, "ages" it for some weeks, and then coats it successively with shellac and with silver or gold leaf. Finally he paints in the life colors and markings of the fish by hand, and gives the model a protecting coat of varnish.

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

Dogs and Convicts Aid Pellagra Sufferers

Medicine

MISSISSIPPI FLOOD SUFFERERS were given thousands of pounds of yeast by the Red Cross, and so what might have been a serious pellagra epidemic was prevented

By MARJORIE MACDILL

Another vitamin has come to light that already, in the short time that it has been known to science, has been the means of bringing life and hope to thousands of stricken sufferers.

Workers in the fields of nutrition and physiology recognize five vitamins as necessary for health and growth of the human body. From one of these, the anti-neuritic vitamin B, there has been split off a factor, P-P. that has the distinct property of preventing pellagra, a disease that successfully baffled physicians of the Old and New World for two hundred years.

Known for generations among the poverty-stricken peasants of southern Europe, pellagra was recognized about twenty years ago as being undeniably and uncomfortably frequent among the poor whites and negroes of our own South. Federal investigation was ordered and a corps of experts from the U. S. Public Health Service was put to work on the problem. Chief of these was Dr. C. H. Lavinder, later succeeded by Dr. Joseph Goldberger of the U. S. Hygienic Laboratory, who now, after fourteen years of research, has shown that the disease that almost everyone thought was infectious, is not due to a germ at all but comes from a faulty and unbalanced diet.

Pellagra is a painful malady of disturbed digestion, accompanied by distressing skin eruptions, that sometimes terminates in insanity and death. The fact that it recurs frequently in the same individual has been interpreted by many physicians to mean that it is a long drawn out disease lasting for years, with periods of quiescence and activity. The modern view, however, considers that the recurrences are simply due to a repetition of the circumstances that bring about the disease. In other words, the continued use of the same unbalanced diet brings about repeated attacks of pellagra.

Because of inadequate reporting it is hard to obtain exact figures of its incidence, though thousands of cases are known to occur, particularly in the South in years of financial depression. It is characteristically a disease of poverty that has followed the bad cotton years like a gaunt specter. It shows, moreover, a marked seasonal variation, dying down in the fall and winter, only to flare up with hundreds of new cases in the spring and summer during the busy season, when all hands should be in the fields.

The three M's—meat, meal and molasses, main bill of fare of the one-crop tenant farmer while waiting for his cotton crop to mature, is the most fruitful immediate cause of pellagra, in Dr. Goldberger's estimation. This does not mean that these staples are not safe, substantial articles of food, but it does mean that they do not contain certain vital principles necessary to prevent the onset of pellagra.

The coarse, monotonous menu was suspected from the very first by the workers trying to unravel the mystery of pellagra's origin. Attempts were made to induce the disease by such a diet in the laboratory in rats and chickens, but were not a success. At the same time, attempts to pass the disease from humans to animals by inoculation, which would have been conclusive proof that it was infectious, were not successful either. A diseased condition in rats similar to pellagra, however, was found to be considerably improved by certain diets.

The next step was to try experimental diets in insane asylums and prisons in the South, where the pellagra incidence among the inmates was very high. Many valuable observations of this sort were made at Milledgeville Sanitarium in Georgia but what was, perhaps, the most interesting experiment took place at the Rankin Prison Farm of the Mississippi State Penitentiary.

On the offer of a pardon, twelve convicts were found willing to undertake a diet that the doctors thought might induce pellagra experimentally. The bill of fare consisted mainly of unappetizing cereals, with few variations that would appeal to epicures. The members of the Pellagra Squad, as it came to be called, were kept under guard and segregated, so that no food other than the prescribed diet could be obtained. The controls, mostly officials, were given the same menu, but with certain additions of milk, butter, lean meat and eggs. Of the eleven volunteers who remained in the test to the end (one escaped before the experiment was finished), six developed pellagra, while all of the controls remained in good health.

Evidence continued to pile up that pellagra was due to some lack in the diet, but just specifically what element in food prevented its occurrence still eluded the investigators. Finally a clue came from some work with dogs.

Dogs are subject to a disease that veterinarians call black tongue that shows many points of resemblance to pellagra in (*Turn to next page*)

Aiding Pellagra Sufferers—*Continued*

DR. JOSEPH GOLDBERGER of the U. S. Hygienic Laboratory, who, for 14 years, headed the pellagra research. Finally his work culminated with the discovery of vitamin factor P. P.

human beings. One of the men at the Hygienic Laboratory tried to produce black tongue with an experimental diet, but since laboratory food lists do not always exercise an appeal to doggish gustatory sensibilities, a small amount of yeast was included as an appetizer. Yeast, any nutrition expert will explain, is a rich source of vitamin B, a potent factor in inducing appetite.

This particular group of dogs failed to develop black tongue, but a record of the work and its results was carefully filed away. A different line of research was taken up and the work on black tongue was side-tracked for a time. Eventually, however, it was taken up again, and the records were pulled out to see what diets had been used in the past. It was noticed that the diet in which yeast was used did not produce the desired disease. Accordingly, regardless of appetite, another group of dogs was fed on a diet that did not include yeast. In due course of time these dogs developed black tongue and it dawned on the investigators that here was a lead. Yeast might be the preventive. Yeast, as was well known, contained the antineuritic vitamin B, likewise responsible for appetite and a preventive of beri-beri, a deficiency disease somewhat like scurvy.

"Was this versatile vitamin also a pellagra preventive?" the scientists asked themselves. Further experiments showed that this was not quite true. The pellagra preventive factor, P-P, can be completely separated from vitamin B and has been used in a relatively pure and concentrated form in the laboratory, but yeast continues to be the convenient form in which it is administered to pellagra patients.

Lean meat, fresh vegetables and milk also contain the newly recognized life-giving factor and should be included in the daily menu of every pellagrin.

"Why bother," explained Dr. Goldberger, "to give out concentrated medicine to prevent pellagra when a little yeast, or, better still, a half of a pound of beefsteak will do the trick and is much more interesting?

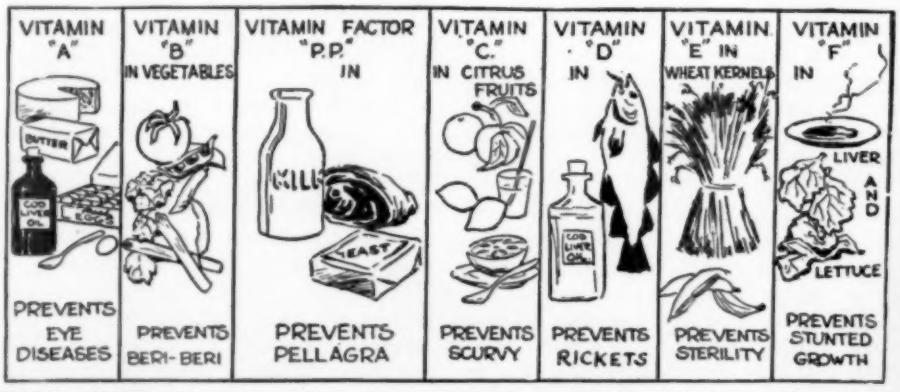
"A half an ounce of dried pure yeast a day," he added, "will prevent the appearance of pellagra, even though the daily diet lacks all other foods that will help prevent the disease."

Acting on this advice from the U. S. Public Health Service, the Red Cross distributed some 11,500 pounds of yeast to refugees in the stricken states inundated by the Mississippi flood. It was inevitable in the distressed times that followed the flood that many cases of pellagra should develop from lack of a properly balanced diet, but the colossal mountain of Red Cross yeast undoubtedly did its bit in holding a serious outbreak in check. Many southern hospitals and asylums now include yeast in the patients' diet and the number will probably be increased as time goes on.

Dr. Goldberger and Edgar Sydenstricker, chief statistician of the U. S. Public Health Service, made an extensive survey of the pellagra situation in the flood states immediately after the water subsided. On their return they reported that, in their estimation, diversification of crops and the improvement in the supply of milk through more farmers owning cows would do more to eradicate the disease in the South than any other measure.

From the survey made by Dr. Goldberger and Mr. Sydenstricker, it is estimated that the number of pellagra cases in 1927 was around 50,000, with deaths ranging from 2,300 to 2,500. This forecast, made by the experts in the field, led the U. S. Health Service to broadcast information on the prevention and treatment of the disease. Unfortunately, the early symptoms of the disease are indefinite. Nevertheless, in the regions below the Potomac and the Ohio, where the disease is most prevalent, suspicion should be aroused by lack of strength, headache, indigestion, nervousness and pain. If these rather general manifestations are followed up with burning of the hands and feet, a reddened tongue and diarrhœa, the evidence of pellagra is more definite. In more advanced cases, skin eruptions appear, followed by a parchment-like aspect of the skin, which may become rough and scaly, eventually cracking and peeling off. The backs of the forearms, hands and feet are the most common sites of peeling skin. Inquiry usually elicits the information that the victim has been living on salt pork, cornmeal and molasses, a diet that does not contain enough of the pellagra preventive vitamin to forestall the onset of the disease.

Suitable quantities of milk, vegetables, fruits, lean beef, mutton, fish, fowl, yolks of eggs and powdered yeast consumed regularly are the best preventive as well as cure. The yeast plant, the most potent source of the vitamin yet (*Turn to page* 299)



THIS CHART shows the place of the Pellagra Preventing vitamin in the vitamin family, as so far known

New South American Volcano

Volcanology

By Joseph H. Sinclair

Mr. Sinclair was leader of the American Geographical Society's Expedition to South America.

An active volcano of the explosive type, hitherto unmapped and unknown to science, was discovered by the American Geographical Society expedition to South America, under my leadership. We have just returned to this country.

The volcano is situated in eastern Ecuador at the point located on the map at latitude zero degrees eight minutes south and longitude 77 degrees 32 minutes west of Greenwich. It is the volcano closest to the equator. The discovery was made on December 21, 1927, by my party, of which Mrs. Sinclair was a member. The purpose of our expedition was to make a detailed topographic survey of this South American area.

So far as we can ascertain, there is no reference to this volcano in history. Although I approached within fifty miles of the region in 1921, I heard nothing of its existence.

Activity of this volcano began suddenly with violent explosions at the end of 1925. The most authentic eye-witness of the eruptions is a native, named Miguel Canchala, who lives in Quijos valley, about 60 miles east of Quito. He stated that the entire top of the cone disappeared in the course of the explosions. Ash filled the sky 100 miles distant and detonations were heard over 65 miles in an air line from the crater. I first heard of the eruption on arrival in Quito, in September, 1927.

From Quito we proceeded east over Guamani pass, 13,350 feet above the sea, carrying a traverse line for survey purposes from the astronomical observatory of Quito. We descended the east slope of the Andes by way of the Quijos valley and reached a point 60 miles east of Quito and 6,000 feet above the sea. Here we met Canchala.

It was necessary, however, to abandon progress in this direction because of the refusal of Indians to accompany us through fear of destruction by further eruptions. We turned south, traversing to Rio Napo, 100 miles from Quito, and then descended this river 100 miles to the mouth of the Rio Coca whose position we determined by our surveys in 1921.

This hitherto unknown stream was ascended and we traversed the route by stadia and plane table. On this journey we were accompanied by Canchala and Payamino Indians.

On December 21 we arrived in the vicinity of the volcanic cone, as calculated from the intersection of survey bearings to center of smoke area from Quijos River and Quito. We were then 75 miles above the mouth of Rio Coca in a canyon 2,000 feet deep, with cliff walls. We were running short of food and the Indians refused to continue farther. We persuaded them to go two days more. We then ascended the ridge to an elevation of 4,000 feet above the sea and found ourselves directly opposite jagged remnants of the cone, which Canchala recognized and which was the only prominent feature in the forested area. Between ourselves and the crater we discovered an unknown river in a deep canyon with cliff walls. The distance of about 6 miles to the crater was impossible to cross, for the way was barred by a mass of dangerous rapids in the river, which would have necessitated detouring far to the north.

It was, therefore, necessary to turn back. We hoped to return down the Quijos valley from the west, but heavy rains set in. There is no possibility of making this further exploration until the next dry season, which is said to begin in August.

The volcano breaks through middle cretaceous sediments in a heavily forested and uninhabited region, whose elevation is about 4,000 feet above the sea. The remnants of the cone attain an elevation of between 6,000 and 7,000 feet above the sea and the crater appears very large. In this region the rainfall is almost continuous, the difference between dry and wet seasons being merely in degree of rain. (*Turn to next page*)

Westward Atlantic Flight Hazardous

Aviation

By Thomas Carroll

Mr. Carroll is chief test pilot of the National Advisory Committee for Aeronautics.

Now that the Atlantic has been spanned by air in both directions it may appear to those who think that luck plays any great part in such undertakings that fortune has smiled more consistently on the east bound.

So it is the more remarkable to note some figures from the U. S. Navy Hydographic charts of the Air Conditions over the North Atlantic Ocean.

The adversity of the winds is common knowledge but is too frequently considered by the landsman as just a little wind more or less. But see what a difference just this wind condition can make.

Take a course between a point near New York and one in Ireland which is just 3,000 miles long and use an airplane that cruises at a speed of just one hundred miles an hour.

If a flat calm maintains and two pilots start in opposite directions at the same time and they are both equally capable of maintaining their course and have engines and instruments that never quit it is easy to see that they will reach their destinations simultaneously in just thirty hours. Trains and all ground transportation operate on such a schedule but we find from the chart that these conditions can be expected for only five per cent. of the time in any reasonable period. Five per cent. of thirty hours is only one and a half hours and is therefore out of consideration.

Take the east bound flyer. His most optimistic prospect is for an average following wind of 28 miles per hour and that it may maintain for 24 per cent. of the time in any hundred hour period. It is therefore possible to expect that his average speed will be increased to 128 miles per hour and even possible that it may maintain for the whole trip. That would bring him to his destination in twenty-three and a half hours.

On the other hand the worst that the east bound flyer may expect according to the chart is an unfavorable wind averaging eleven miles an hour. If this is maintained for the whole trip this would only decrease his speed to 89 miles an hour and he would still arrive in thirty-three and one half hours. But again to his advantage he need only expect that these adverse conditions will continue for but five per cent. of the time and that over very (*Turn to next page*)

The Light Game

Physics

A few years ago there appeared the following item in the afternoon edition of the *Physics Daily News*:

Waves and Corpuscles
In Hard Fought Game

WAVES LEAD, END OF THIRD QUARTER

(By Ray O. Light)

The big game opened with a kick-off by Galileo, veteran full-back of the "Waves." The ball was received by Isaac Newton, the strategic quarter of the "Corpuscles," who stiff-armed Huyghens, the giant tackle of the Waves, and carried the ball for a 45-yard gain. Then by a series of skillfully directed trick plays and forward passes, he led his team through to a touchdown at the end of the first quarter. La Grange failed to kick goal. Score, Corpuscles 6; Waves, 0.

Fresnel, captain of the Waves, elected to receive, and himself caught the ball. Tom Young organized an interference which completely overwhelmed the Corpuscles, and Fresnel ran the length of the field for a touchdown. The electric toe of Maxwell kicked the ball for a goal, giving Waves, 7; Corpuscles, 6.

At the beginning of the second half Maxwell was put in as quarter for the Waves, and with the help of the famous backfield, consisting of Hertz, Kelvin and Michelson, they had things their own way, scoring two touchdowns. Score at the end of the third quarter, Waves, 20; Corpuscles, 6.

As the last quarter opened, Planck, of the Corpuscles, made a long kick-off to Jeans, of the Waves, who was able to return the ball only a few yards. A forward pass was intercepted by Einstein, right end of the Corpuscles, who crossed the line with the velocity of light for a touchdown. The game during the next few minutes was very hard fought, neither side being able to make a first down. At the time this edition goes to press the Waves are in the lead by 7 points, but the Corpuscles seem to have the upper hand.

Prof. Arthur H. Compton brings the report up to date in the *University of Chicago Magazine*:

How, then, about our football game? Let us say that the strategy associated with the scattered X-rays has given the corpuscles another touchdown, and that Wilson, by finding the electrons recoiling from the scattered rays, has kicked a beautiful goal. The score thus stands: Waves, 20; Corpuscles, 20. At this stage the referee must call the game of light on account of darkness.

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Westward Flight—*Continued*

large portions of the route they rarely if ever exist.

Now regard the poor west bound pilot.

With the above conditions reversed you find that the best he can expect is to increase his speed to 111 miles per hour and reach his destination in twenty-seven hours and again that he can hardly expect that assistance for more than five per cent. of the time. His worst condition shows that his speed may be reduced to 72 miles per hour for at least one quarter of the trip while if it holds for the whole trip, which is more than a possibility, he will not arrive at his destination until forty-one and two-third's hours have elapsed. So while his best expectations are only five hours better than his east bound competitors worst, his own worst conditions will require him to be in the air eighteen hours longer than the east bound plane or very nearly twice as long.

As if this is not bad enough, there is the fog hazard to be negotiated. Of course, with fog on the course, and it can be expected from one-third to one-half of the time this month, both east and west bound will encounter it. But the east bound plane can at least maintain land contact through most of it and expect to be out of it in a couple of hours after leaving land, for the worst of the fog is near the coast of Nova Scotia and Newfoundland. They may then expect to approach the Irish coast in clear weather, for fog is expected only ten per cent. of the time there.

But the unfortunate west bound plane must approach a fog bank two or three hundred miles off the coast of America into which he must fly and grope for his destination for twelve or more hours. Remember that landmarks must be good to be recognized in a fog at a hundred miles an hour.

If you ever fly to Ireland it is to be recommended that you come home on a boat.

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Volcano—*Continued*

The crater is constantly covered by mist, which may be in part steam. We only saw the jagged remnants of the cone twice, although it was so close to us and we had an unobstructed view.

Our position on the day of discovery was 300 miles from Quito. Most of our journey was through frightful trails in wet forests and on dangerous rivers. I believe the volcano could be reached from the west with much shorter distance if the Indians could be secured. But many torrential rivers are in the way.

We discovered also that the lowest sedimentary rocks in Ecuador are middle cretaceous and rest upon complicated old volcanic rocks, which we will describe after petrographic studies. An uncharted mountain mass on the equator in longitude 77 degrees 18 minutes west of Greenwich was revealed by our explorations. This is isolated and reaches elevations about 10,000 feet above the sea.

Another interesting feature of the exploration is the extension of volcanic centers from the high Andes to the lowlands east of the main range. About 25 miles south of El Reventador lies the great volcanic cone Sumaco, 12,750 feet above the sea, whose lavas we have recently found to be of feldspathoid type, the first known in Ecuador. We believe other centers will be found east of the Andes.

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Hall of Fame for Agassiz and Morse

History of Science

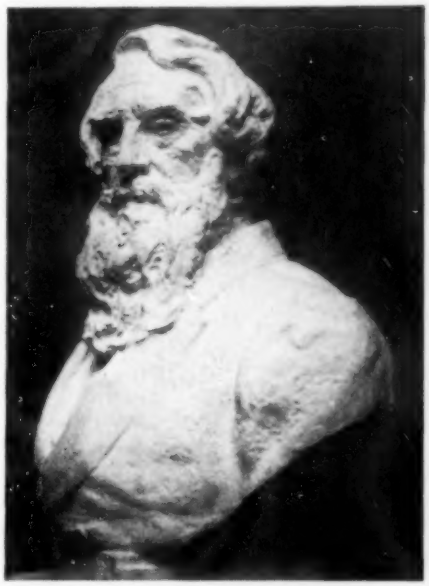
The Hall of Fame for Great Americans, located on the campus of New York University, was visited on Thursday, May 10, by thousands of people from many different states and cities, who witnessed the unveiling of the busts of five great Americans.

The men honored with busts this year were Louis Agassiz, Rufus Choate, John Paul Jones, Samuel Finley Breese Morse, and John Greenleaf Whittier.

The busts were the gifts of patriotic organizations, societies and individuals, honoring persons whose names have already been inscribed in the Hall of Fame. Many distinguished representatives of the different arts and professions, together with many descendants of the persons honored, participated in the ceremonies.

Presentation of the bust of Louis Agassiz, the zoologist, modeled by Anna Vaughn Hyatt (Mrs. Archer M. Huntington), the gift of the American Association for the Advancement of Science, and of an admirer of Agassiz, was made by J. Walter Fewkes of the Smithsonian Institution. Mrs. Huntington's father and Mr. Fewkes were both pupils of Agassiz. The unveiling was by Dr. Anna Agassiz Prince, great-granddaughter of Agassiz. An address was made by Dr. Henry Fairfield Osborn.

Louis Agassiz, zoologist, was born at Motier, Switzerland, May 28, 1807, and died at Buzzard's Bay, Mass., December 14, 1873. He early showed a strong leaning toward zoology, and after being graduated in medicine at Munich, he began an intensive study of natural history. He was professor of zoology at Harvard. He founded a summer school for the study of zoology. He ranks as the most influential of American naturalists and is regarded as a great teacher and inspirer of scientists.



SAMUEL F. B. MORSE, from the bust now in the Hall of Fame

A granddaughter of Samuel Finley Breese Morse, the inventor of the recording telegraph and founder and first president of the National Academy of Design and a member of the faculty of New York University, Miss Leila Livingston Morse, unveiled the Morse bust modeled by Chester Beach, which was the gift of the Morse Hall of Fame Memorial Committee. Richard E. Enright, former Commissioner of Police, New York City, and chairman of the committee, presented the bust.

Samuel Finley Breese Morse, inventor of the electric telegraph, was born at Charlestown, Mass., April 27, 1791, and died at New York City, April 2, 1872. He was graduated at Yale and took up the study of painting, becoming first president of the National Academy of Design. In 1837 he exhibited a perfected electric telegraph instrument. He was the originator of submarine telegraphy.

Dr. John H. Finley, president of the American Geographical Society, spoke of Samuel Finley Breese Morse as an inventor, while Professor Frank Jewett Mather, Jr., of Princeton University, spoke of Morse's relationship to art.

Of the sixty-five personages enrolled in the Hall of Fame, busts of forty-nine have now been provided. New names are chosen every five years by approximately one hundred electors, composed of Americans, men and women representing every state in the Union. Only Americans who have been dead for twenty-five years are now eligible for election.

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Rays Show Tooth Cavities

Dentistry

Teeth, shining like jewels in the dark under the invisible rays of ultra-violet light, reveal by dark spots the places where cavities are beginning to develop, before they become visible to ordinary inspection. If the technique of this kind of examination can be sufficiently perfected, we may expect dentists' offices to be equipped with the largest types of ultra-violet lamps, to enable up-to-date practitioners to catch cavities before they happen, and so perhaps prevent them.

This possibility is an outgrowth of experiments by Dr. H. C. Benedict, of Northwestern University Dental School, on the fluorescence of teeth under ultra-violet radiation. Like many other substances, human teeth react to these invisible rays by shining brightly with a visible light. This phenomenon is known as fluorescence.

The white spot that marks the beginning of cavity-forming troubles, Dr. Benedict found, does not fluoresce even though no coloring matter has begun to form on it. This seems to be associated with the removal of a thin protective film, for it was found that a similar effect could be obtained by treating a paraffin-coated tooth with acid. Wherever the paraffin had been scratched through, the tooth failed to fluoresce.

Dentine, which forms the foundation substance of teeth, fluoresces more brightly and with a bluer light than does the hard outer coating of enamel.

Calculus, the so-called "tartar" that has to be scraped off teeth, fluoresces. There are two kinds of calculus. The kind formed through the influence of the serum, or blood fluid, fluoresces very little, but that formed by saliva shines with a bright orange color on living teeth. On some old museum specimens, the salivary calculus fluoresced with a white light.

Science News-Letter, May 12, 1928

Some Sayings of Agassiz

Natural History

David Starr Jordan in his personal recollection of "Louis Agassiz, Teacher" in *The Scientific Monthly*, Nov., 1923, quotes from his notebooks of the outdoor teaching at Penikese what Agassiz said of his method of nature study:

Never be afraid to say "I do not know."

Strive to interpret what really exists.

I feel more vexed at impropriety in a scientific laboratory than in a church. The study of nature is intercourse with the Highest Mind. You should never trifle with Nature. At the lowest, her works are the works of the highest powers, the highest something in the universe in whatever way we look at it.

I have been criticised in Europe as one who derives his scientific ideas from the church. I have been regarded in America as an infidel, because I will not be dictated to. I will not suffer my church-going friends to pat me on the head.

Have with traditional belief and dogmatic science nothing to do. Scrape it off. If we are weak let us humbly fall back for support on tradition and belief. If we are strong let us see what there is outside of these.

Never try to teach what you yourself do not know, and know well. If your school board insists on your teaching anything and everything, decline firmly to do it. It is an imposition alike on pupils and teacher to teach that which he does not know. Those teachers who are strong enough should squarely refuse to do such work. The much-needed reform is already beginning in our colleges, and I hope it will continue. It is a relic of medieval times, this idea of "professing" everything. When teachers begin to decline work which they cannot do well, improvements begin to come in. If one will be a successful teacher, he must firmly refuse work which he cannot do successfully.

It is a false idea to suppose that everybody is competent to learn or to teach everything. Would our great artists have succeeded equally well in Greek or calculus? A smattering of everything is worth little. It is a fallacy to suppose that an encyclopedic knowledge is desirable. The mind is made strong, not through much learning, but by the thorough possession of something.

Lay aside all conceit. Learn to read the book of nature for yourself. Those who have succeeded best have followed for years some slim thread which has once in a while broadened out and disclosed some treasure worth a lifelong search.

A man cannot be a professor of zoology on one day, and of chemistry on the next, and do good work in both. As in a concert all are musicians—one plays one instrument, and one another, but none all in perfection.

You cannot do without one specialty; you must have one base-line to measure the work and attainments of others. For a general view of the subject, study the history of the sciences. Broad knowledge of all nature has been the possession of no naturalist except Humboldt, and general relations constituted his specialty.

Select such subjects that your pupils cannot walk without seeing them. Train your pupils to be observers, and have them provided with the specimens about which you speak. If you can find nothing better, take a housefly or a cricket, and let each hold a specimen and examine it as you talk.

In 1847 I gave an address at Newton, Massachusetts, before a Teachers' Institute conducted by Horace Mann. My subject was grasshoppers. I passed around a large jar of these insects, and made every teacher take one and hold it while I was speaking. If anyone dropped the insect I stopped till he picked it up. This was at that time a great innovation and excited much laughter and derision. There can be no true progress in the teaching of natural science until such methods become general.

There is no part of the country where, in the summer, you cannot get a sufficient supply of the best specimens. Take your text from the brooks, not from the book-sellers. It is better to have a few forms well known than to teach a little about many hundred species. Better a dozen specimens thoroughly studied as the result of the first year's work than to have two thousand dollars' worth of shells and corals bought from a curiosity shop. The dozen animals would be your own.

Teach your pupils to bring in their specimens themselves, and above all teach them how to handle them. The earlier this training is begun the better. There is not one person in fifty who knows how to handle a valuable specimen without injuring it, and not one in ten who will submit to being taught.

Talk about your specimens and try to make the pupils observe the most striking and telling features. When you collect a specimen, be sure and find out what it is, or if you have not the means at hand, take such notes as will help you to find its name when you have opportunity. Better let a specimen go without a name than to give it a wrong one.

There should be a little museum in every school room; a half dozen Radiates, a few shells, a hundred insects and a few fish, reptiles, birds and mammals would be sufficient to teach well. De Candolle, the great botanist, once said that he could teach all he knew about botany with a dozen plants.

If you study nature in books, when you go out-of-doors you can not find her.

The book of nature is always open. All that I can write or say shall be to make them study that book and not pin their faith to any other.

This is the charm of study from Nature herself; she brings us back to absolute truth whenever we wander.

Science News-Letter, May 12, 1928

Our Savage Nature

Psychology

JOHN B. WATSON, in *Harper's Magazine:*

So far, counting the millions of years society has been shaping human lives, a pretty poor job has been done. We are still very close to the savage; strip off a little of the verbal veneer and polite behavior of the hands, feet, and trunk, and the raw, primitive stuff shows through.

The savage was all right for his time. Our argument is that you can't fit a savage to live in New York by teaching him only English and how to behave with his hands. It is essential to train his gut as well. This is one reason why human beings are so restless—they have the speech and manners of a Chesterfield and the gut behavior of an "Emperor Jones."

Science News-Letter, May 12, 1928

Two plant explorers from the U. S. Department of Agriculture have returned from Africa with seeds of more than 160 different grasses and forage plants.

Sewage a Constant Menace in Cities

Medicine

Following are reported some of the interesting papers presented before the various societies that met recently in Washington in connection with the sessions of the Congress of American Physicians and Surgeons.

Large cities complacently viewing new waterworks, reservoirs and conduits and feeling secure in their endeavor to give their citizens pure water will be interested in warnings contained in the presidential address of Dr. Theobald Smith, pioneer American student of bacteriology, before the Congress of American Physicians and Surgeons.

"The sewage problem is unsolved," he said. "All we have done is to convert our water courses into open sewers with occasional explosive outbreaks of intestinal disease as the result. The time is coming when the intimate relation between water supply and sewage disposal will suddenly develop acute crises in the sanitary affairs of large communities."

Although civilization has widened the aseptic zone about the individual and through cleanliness has decreased many diseases, nevertheless, as Dr. Smith demonstrated, the great industrial concentrations of people have counteracted this advance to some extent. Colds, pneumonia, influenza, and other respiratory diseases will probably increase, he predicted.

Nor is mankind confronted with a static, known array of enemies in the germ world. New diseases are likely to appear. The virulence of disease organisms waxes and wanes, the microorganisms themselves undergo changes and learn how to attack those peoples and animals that have seemed to be immune to them.

Dr. Smith, head of the Rockefeller Institute's animal pathological laboratories near Princeton, N. J., considers the animal world as a great reservoir of potential human disease. Some animals play a damaging role in the cycle of dread maladies, such as the rat in the bubonic plague, but there are many other diseases, which human beings can contract, which lack only one link to make them a powerful menace to the race.

Had the early races of man discovered and used any method of rapid transportation, Dr. Smith said, it would have been highly destructive or fatal. Infections, fresh and active due to the animal surroundings of our early ancestors, were in the caveman days kept isolated by the lack of travel and the slow migrations. If in the present progressive economic era the preventive work of medicine was stopped and the germs given free play, Dr. Smith would expect a world with stationary or backsliding population and economic situation.

Such statements from some could be disregarded and discounted, but it must be remembered that Dr. Smith, who made the first experiments on immunity, in 1886, has seen the modern science of medicine rise in the last forty-five years and has tended it with his own skilful hands.

Rheumatic Fever Still Puzzle

Good, old-fashioned "rheumatiz," that quite respectable disease that was more prevalent and more talked about in the turn of the century era, has taken on dignity in recent years, but rheumatic fever, as it is now known, is still a most baffling and pressing problem of medicine.

Physicians gathered for the Congress of American Physicians and Surgeons were presented with some of the latest developments in the fight against rheumatism.

A serum developed by Dr. J. C. Small of Philadelphia, has given promising results in the treatment of this disease. Some 270 cases have been subjected to treatment by this curative agent within the last year and some have recovered while many have improved. A type of streptococcus isolated by Dr. Small from cases of rheumatic fever was used in developing the serum, which in its present state of development must be used with care in order to prevent undesirable acute reaction. Further laboratory work is in progress in the hope of improving the serum and eliminating the dangers.

Although rheumatism does not occur in epidemics, most physicians are convinced of the infectious nature of the disease, Dr. M. J. Rosenau of Boston declared. In some localities there are houses that have a reputation for causing the disease, and Dr. Rosenau gave as the scientific basis for the existence of these "rheumatism houses" the idea that the prevalence of the disease is due to human carriers. Typhoid fever is known to be spread by apparently well persons who, because of an attack of the disease sometime in the past, harbor and pass on to others virulent germs of the disease. Children of twelve are most in danger of contracting rheumatism. It is not a disease of old age as popularly supposed since only one in seven cases are over forty years of age. Fortunately, like scarlet fever, there seems to have been a downward trend in the world prevalence of the disease during the past twenty years. In addition to this actual decrease, some joint disorders and aches and pains that went by the name of rheumatism when we were young are now credited to their true cause, thus brightening somewhat the reputation of rheumatic fever.

Reduce Hundred Pounds a Year

The vogue for thinness is encouraged and aided by physicians when health will be improved by a loss of weight. A method of reduction by drastic diet that can remove seventy to a hundred pounds within a year was described by Dr. Frank A. Evans of Pittsburgh. The hoped for weight regulates the number of calories of food the patient is allowed each day. Fats are reduced to a minimum while proteins and carbohydrates are allowed in proportions similar to those in normal diets. After a few unpleasant days, the reducers usually like the regimen and stick to it until they reach optimum avoirdupois.

New Sense Predicted

A hitherto undiscovered animal sense, the power that allows the homing pigeon to locate its loft, the migrating bird its distant summer home, the animal its burrow, is on the verge of being revealed to science. At the sessions of the Congress of American Physicians and Surgeons Dr. Frederick Tilney, professor of neurology at Columbia University, mentioned experiments now in progress upon this new sense, which may prove to be the magnetic sense. The retina of the eye may prove to be the organ of the body in which the sense resides.

Mere men have long marveled at the ability of animals to find their way home through strange surroundings. Aviators need compasses and intricate instruments to navigate as efficiently as birds of the air. Such phenomena as these gave impetus to Dr. Tilney's researches.

One clue in the search that is now under way is the fact that animals are greatly disturbed by any change of direction of their surroundings. Mice or rats that (*Turn to next page*)

Medical Meetings—*Continued*

are taught to run intricate mazes, a feat that is not dependent upon ordinary senses of sight and smell for instance, are completely baffled when the mazes are moved and oriented geographically in a different direction. They have to learn the mazes all over again.

Dr. Tilney was careful to tell the scientists that as yet his researches are in a very preliminary stage. Both his own laboratories and those of the department of psychology at Columbia University are at work.

If this magnetic sense is confirmed by his experiments, it will be the ninth sense. Five senses, sight, hearing, touch, taste and smell, which are the result of contact of the nervous system to environment, are familiar to everyone. Then there are what Dr. Tilney called the skeletal sense and the visceral sense, both of which originate in the body itself. As the eighth, Dr. Tilney lists what he calls the hurt or pain sense, which is protective instead of guiding like the others.

Man uses only about twenty per cent. of his brain power, Dr. Tilney declared in predicting that human evolution will proceed still further and make man, at present an unfinished product, a much more marvelous being than most of us now imagine. The realization that there is such a process as evolution will cause the human race consciously to speed its improvement.

Helen Keller he held up as an example of the possibilities of effectively utilizing the senses that we have. Miss Keller, deaf and blind, has no better senses than a normal person, but she has developed her sense of touch, for instance, nearly 100 per cent. making it serve where the ordinary person would use eyes and ears.

New Cancer Diagnosis

A method of diagnosis of cancer may develop from the work reported by Dr. William Lester Mattick of Buffalo. Now it is difficult to detect this disease in its early stages. Examining the blood of 100 cancer cases, Dr. Mattick found that for 85 of them the chemical compound, cholesterol, is present in greater quantities in the liquid portion of the blood than in the blood cells. In eighty normal individuals just the opposite condition was found to exist. The same relationship was found to hold in cancerous and normal mice. Further investigation of the effect of other diseases upon the cholesterol ratio is planned and may allow the development of this ratio as a test for cancer.

Use Rickets Remedy With Care

Irradiated ergosterol, the potent new rickets remedy, one ounce of which will do the work of six tons of cod liver oil, is one of the most powerful specific substances which has thus far been isolated.

Dr. Alfred Hess of Bellevue Hospital, New York City, told the American Pediatric Society that one twenty-five thousandth of a milligram of this parent substance of vitamin D, an amount almost inconceivably small, is sufficient to protect a rat from rickets when added to his daily ration.

The curative effects of irradiated ergosterol were discovered about a year ago by the combined efforts of Dr. Hess and Prof. A. Windaus of the University of Goettingen in Germany. English investigators working independently also achieved the same results at about the same time.

Dr. Hess has been using the new remedy in his clinical work and reported that babies that receive from two to four milligrams a day are almost regularly cured of rickets.

"The question arises," declared Dr. Hess, "as to whether this substance may not to a large extent replace cod liver oil in view of the fact that it can be given in any desired potency and that it has the advantage of being tasteless and odorless. Subsequent clinical tests carried out during the past year have served only to emphasize the practical usefulness of this new remedy. It is an absolute specific for rickets as well as for tetany, disorders which are so often associated, and it brings about healing of the bones more quickly than any substance which has heretofore been used. The appetite and general condition of the child also show a marked improvement.

"A word of warning should be uttered in this connection. Irradiated ergosterol is so powerful that there is a temptation to use it in exceedingly large doses. It is being frequently prescribed in doses which are 100, or even 500 times greater than cod liver oil. Such amounts are quite unnecessary and may even be harmful. A remedy which is so potent for good may, when given in excess, bring about changes which are as yet unknown and unsuspected."

Poliomyelitis Epidemic

Another infantile paralysis outbreak in the summer and autumn of 1928 was a possibility forecast by Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research at the meeting of the Association of American Physicians. To prepare for this grave contingency, specialists of the research staff of the Institute are hard at work endeavoring to find the most effective method of combatting this dread disease with convalescent serum, the only specific known at the present time.

The blood of persons who have had infantile paralysis is known to possess the property of neutralizing to a certain extent the effect of the virus, and if administered early enough, will mitigate the paralytic after-effects that make this disease so alarming to the parents of young children. In anticipation of another epidemic, some of the states hard hit by the epidemic last summer, notably California, have instituted what Dr. Flexner termed "revolving funds" to be used for collecting blood for serum and to provide for its release to competent physicians. Donors, who have recovered from the disease, will be paid for their blood while the proceeds from the sale of the serum will be turned back into the fund.

The point of the infantile paralysis experiments which are being carried out in the Rockefeller Institute laboratories with monkeys, is to find out if it is sufficient to administer the serum directly into the cerebro-spinal fluid by lumbar puncture. The practice has been to inject it into the spinal cord and also into the veins or muscles. If the desired results can be obtained by using lumbar puncture alone, as the experiments at the present time seem to indicate, a great saving of the precious fluid will be effected by injecting it into the body system through only one avenue instead of two.

Convalescent serum was widely used by Dr. W. L. Aycock of Boston in treating infantile paralysis last summer. Though varying degrees of paralysis ensued in over half the cases, he stated, none were as severe as the cases observed in which serum was not used.

Science News-Letter, May 12, 1928

A new kind of artificial ice tested in a German skating rink is said to remain solid at very warm temperatures.

Sun a Pulsating Star

Astronomy

By Gabriella Armellini

Signorina Armellini is director of the Royal Observatory of Rome, and here announces for the first time in English her important discovery.

From time to time, spots are visible on the sun and they are sometimes so large as to be seen by the naked eye, with the help, of course, of smoked glass. When examined through powerful telescopes, these spots appear as holes or fissures in the luminous surface.

Statistics have shown that the sun's surface appears to have the largest number of spots once in every eleven years, after which period a gradual decrease in the number, frequency and size of the spots is noted. At present, the spots are almost at their maximum.

It has now been ascertained, at the Astronomical Observatory of Rome, situated on the Capitol, that the diameter of the sun varies in proportion with the number and frequency of the spots.

The work of ascertaining this fact has been long and difficult, because the variations are slight and take place over long periods. Thus, before the theory could be formulated, several periods of eleven years had to elapse, handing on the result of their investigations as a legacy to those who were to come after them. Every day, at midday, for the last fifty years and more, on clear days, the sun's diameter is measured in the Roman Observatory by throwing the image of the sun on to a white screen, through an astronomical telescope which reproduces the image with a diameter of about one meter.

Measurements are carried out by means of a network of thin cobwebs, and in order to insure perfect accuracy are taken separately by three different astronomers, each of whom repeats the operation seven times.

The results of these observations, which have been carefully collected and investigated, have enabled the fact to be established that the diameter of the sun also varies in every period of eleven years, but that the sun is at its greatest diameter a little before the greatest (*Turn to next page*)

Pellagra—*Continued*

known to science, should preferably be given dead. It can be killed by stirring the dry yeast into water and boiling the mixture for about a minute. The adult dosage is one ounce a day, or two teaspoonfuls taken three times a day. A child under twelve years of age should be given half the adult dose. The diet should be increased as rapidly as the digestive ability of the patient permits. In the average case the patient, if carefully fed, will be fully convalescent in from six to twelve weeks.

The well balanced diet should be kept up all the year round, for one attack of pellagra does not confer immunity. If the diet again becomes deficient, the disease will come back again. One drawback in the poorer sections of the South in the past has been the lack of refrigeration to keep fresh meat during the summer months. This is one reason that accounts for the seasonal recurrence of the disease in the spring and summer months. At this time, too, the "crop money" received for the proceeds of the cotton harvest the preceding fall begins to run short. Consequently, there is less wherewithal for any small supplements to the staple menu of cornmeal and pork. When prices are high, of course, the condition is more aggravated still.

"Under proper treatment and with careful nursing, only a small percentage of cases die," Dr. Goldberger has pointed out. "Nevertheless, the actual number of deaths is deplorably large. As deplorable, if not even more so, is the great amount of sickness and debility, much of it vague and ill-defined, and thus frequently unrecognized, which pellagra must be charged with causing. It is probable that in each year for every death attributed to the disease there are fully 20 persons with clearly recognizable attacks and probably as many more with debility from the same cause, but not definitely marked as such. Indeed, in many of the southern states pellagra is still one of the foremost causes of death. In other parts of the country the disease is very much less common. This difference is due mainly to the different dietary habits of the people in the northern and western part of the country and to the better conditions of food supply."

It is felt by many physicians to be especially fortunate that the cause and prevention of this disease should have been so well worked out at a time of disaster, like the Mississippi flood, when the knowledge was so badly needed.

Nature Ramblings

By Frank Thone

Natural History

Kinkajou

We are often called upon to admire the wonderful help that nature gave to our poor cousin, the monkey, in providing him with a fifth hand in the form of a prehensile tail. Monkeys are not the only prehensile-tailed creatures in the world, but it cannot be denied that they fared better than most other creatures so provided, because they also got long arms and legs out of the evolutionary grab-bag, so that all five of their hands are on a more or less equal footing.

Less lucky is the kinkajou, a tree-dwelling relative of the raccoons, that lives in the American tropics, ranging from central Mexico southward to the Rio Negro in Brazil. The kinkajou has a long and a very handsome tail, with which it can take hold of a branch as readily and as firmly as any monkey. But it is about three sizes too long, when the kinkajou's short, raccoon-like legs are taken into account. Consequently, when the animal has grown tired of swinging from its branch, there is nothing for it to do but take hold of its own tail as though it were a rope or a vine, and climb back up, hand over hand.

A captured kinkajou makes a very attractive pet. With its short, close fur and its intelligent-looking face it looks like a sort of long-tailed live Teddy bear, and it is very fond of being scratched and stroked. It has the decided drawback, however, of being entirely too fond of young birds, and can no more be trusted near a poultry yard during chick-time than a cat. Of course, all this is of little value as a practical consideration in temperate countries, for tame kinkajous have so far been kept only in the tropics. But the time may come when we shall be willing to vary our collection of pets, and in that day the kinkajou may well come into its own.

The Call of the Cow

Agriculture

SYDNEY HILLYARD, in the *Scientific Monthly:*

The United States will be the nursery for the great breeds of the future. One hundred and twenty-five thousand dollars has been paid in this country for a single bull—the world's record for dairy animals. The American wool sheep, the American hog, the American milch cow now lead the world, and we are rapidly coming up in other breeds. There is no knowing what can be done if no armies devastate the farms and no poison gas murders our animals. But let us have peace. We have heard the call of the wild, the call of the carpenter, the call of the cities, and several other calls, now let us hear the call of the cow.

Science News-Letter, May 12, 1928

The London Zoo has acquired a pair of young giraffes from Africa.

Remains of huts 1,000 years old are standing on the shore of the River Thames, in England.

The British government is to spend half a million dollars to encourage the drinking of milk.

Pulsating Sun—*Continued*

number of spots appears. In other words, when the sun is fully covered with spots, its diameter is smaller than when it is free from such spots.

As previously stated, the spots appear to be holes on the sun's surface. It is therefore maintained that in the absence of spots, the gases which form in the interior of the sun cannot find an exit, with the result that the diameter increases.

The spots then appear, and through them come heated gases. The latter pent up in the interior, come violently to the surface, and very often escape in the form of luminous springs, which can be seen with a spectroscope. The diameter of the sun then decreases. Subsequently, the number of the spots also lessens; gases, having no exit, accumulate in the interior, and the diameter once more increases.

The increase and the decrease are very slight, because the oscillation of the radius appears to be about seven hundred kilometers, a quantity which, at the distance of earth from the sun, is only perceptible with the most delicate astronomical apparatus.

The existence of these pulsations having now been ascertained, it is possible to classify the sun among those stars which are known as "pulsating stars," precisely on account of their variability. Therefore, all our planetary system is conducted by a palpitating center similar, as it were, to a huge, fiery heart.

Science News-Letter, May 12, 1928

Naive Natural History

Marine Biology

From *Punch,* reprinted in *Ward's Natural Science Bulletin* for January 1, 1882:

Oh! merry is the Madrepore that sits beside the sea,
The cheery little Coralline hath many charms for me;
I love the fine Echinoderms of azure, green and gray,
That handled roughly, fling their arms impulsively away;
Then bring me here the microscope and let me see the cells,
Wherein the little Zoöphyte like garden floweret dwells.

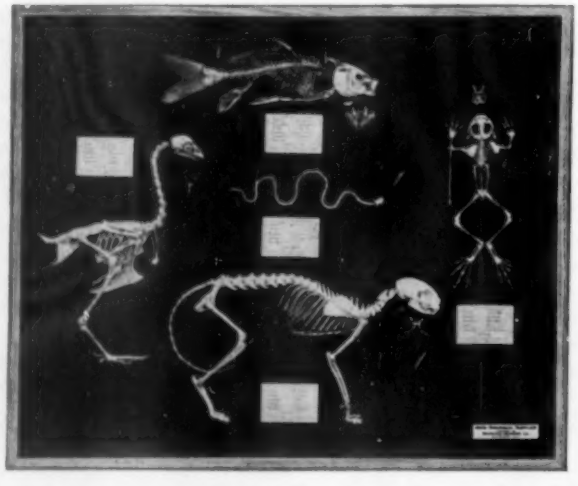
We'll take the fair Anemone from off its rocky seat,
Since Rondeletius has said when fried 'tis good to eat;
Dyspeptics from Sea Cucumbers a lesson well may win,
They blithely take their organs out and then put fresh ones in.
The Rotifer in whirling round may surely hear the bell,
With Oceanic Hydrozoids that Huxley knows so well.

You've heard of the Octopus, 'tis a pleasant thing to know.
He has a ganglion makes him blush not red, but white as snow;
And why the strange Cercaria, to go a long way back,
Wears ever, as some ladies do, a fashionable "sack;"
And now the Prawn has parasites that on his head make holes,
Ask Dr. Cobbold, and he'll say they're just like tiny soles.

Then study well zoölogy, and add unto your store
The tales of Biogenesis and Protoplasmic lore;
As Paley neatly has observed, when into life they burst,
The frog and the philosopher are just the same at first.
But what's the origin of life remains a puzzle still,
Let Tyndall, Haeckel, Bastian go wrangle as they will.

Science News-Letter, May 12, 1928

High Grade Prepared Skeletons



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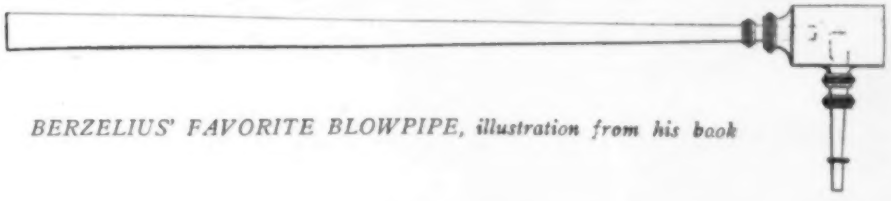
CLASSICS OF SCIENCE: Berzelius on the Use of the Blowpipe

Chemistry

Students of analytical chemistry and mineralogy will be interested to read here the source of the whole technique of blowpipe analysis given in their textbooks.

THE USE OF THE BLOWPIPE In Chemistry and Mineralogy. By J. J. Berzelius (1820). *Translated from the fourth enlarged and corrected edition, by J. D. Whitney. Boston, MDCCCXLV* (1845).



BERZELIUS' FAVORITE BLOWPIPE, illustration from his book

How to Blow

In using the blowpipe, the act of blowing is not directly performed by the action of the lungs, since, in this case, the effort would be injurious, and a continued blast could not be kept up. It is effected by the muscles of the cheeks, which force the air contained in the cavity of the mouth through the blowpipe. Simple as this operation is, it is not easily performed at first, since we habitually exert all the muscles concerned in respiration at once, when we attempt to blow. It is the same kind of difficulty which we experience when we attempt to move the limbs, on the same side of the body, in different directions. It requires some practice not to allow the lungs and the muscles of the mouth to act in concert. The first thing to be attempted is, to keep the mouth filled with air during expiration and inspiration. Imagine the air to escape from a small opening between the lips, the cheeks then naturally collapse, unless a farther supply of air be admitted at the next expiration. A sufficient quantity of air must then be admitted into the cavity of the mouth to keep the cheeks constantly distended. The air, being thus always slightly compressed, escapes in a uniform current from the opening between the lips. This is what takes place in using the blowpipe; the air escapes so slowly from the fine aperture in the blowpipe jet, that it is not necessary to fill the mouth at each expiration. This operation, which is attended with a little difficulty at first, is soon learnt by practice, and, after a short time, it becomes a matter of course, which does not interrupt the process of breathing, and on which it is not necessary to bestow a thought. The only inconvenience is, that the muscles of the cheeks become fatigued at first, which arises from want of practice, and from the fact that the beginner generally presses the mouthpiece of the blowpipe more strongly between his lips than is necessary. The act of blowing is, however, so simple, that it may be easily acquired by any one who has no natural defect in the roof of the mouth.

When the learner can keep up a steady blast, the next thing is, to be able to produce a good flame. For this purpose, a knowledge of the flame and its different parts is required. On looking attentively at the flame of a candle, it will be seen that it consists if several distinct portions. At its base is seen a small dark-blue portion, which becomes thinner as it gets farther from the wick, and which disappears entirely at the part where the flame begins to ascend vertically. In the midst of the flame is the dark portion, which can be seen through the more brilliant part. This space encloses the gases rising from the wick, which are not in contact with the air, and which are therefore not yet fully burned. Around this is the proper illuminating portion of the flame, and on its outer edges will be seen, on looking with attention, a thin envelope, which becomes broader near the point of the flame. This is the place in which the combustion of the burning gases is going on, and is the hottest portion of the flame. If a fine iron or platina wire be introduced into the flame, it will be seen that it is most intensely heated at the point of the flame, and if it be gradually lowered, it will be found that it is most vividly ignited at the points where it comes in contact with the surface of the flame, that is to say, where it touches this thin, feebly illuminating envelope. If a very fine wire be used, its diameter appears much magnified, and this apparent enlargement (which is a phenomenon of the same kind as the apparent diameter attributed to the fixed stars) increases, as the wire approaches the point where the lower blue edge of the flame ends, so that the point where the flame is supplied with the largest quantity of oxygen from the air, is the place of the maximum of heat. Now, when air is forced into the flame with the blowpipe, a long narrow blue flame. appears directly before the jet, being now concentrated into a small cylindrical space, whereas it before formed an envelope around the whole flame. Just before the point of this blue flame is the hottest spot, as in the flame when not acted on by the blowpipe, with this difference, that in the latter cast it formed a ring around the flame, while in the former it is concentrated into a focus; it is thus rendered sufficiently intense to fuse and volatilize substances which were not sensibly acted on by the flame in its usual state. On this is founded the whole theory of the intense heat produced by the blowpipe; the effect, which would otherwise be distributed over the whole surface of the flame, is concentrated into a small space, exactly as if the flame had been turned inside out. The surrounding illuminating portion of the flame prevents the heat from escaping.

Long practice is required to know where the maximum of heat is, since different substances are differently ignited, and the light which they emit is often deceptive. Care must be taken not to blow too strongly nor too gently; since, in the former case, the heat is diminished in intensity by the current of air, and in the latter, a sufficiency of air is not supplied to keep up the combustion. A very intense heat is required when the fusibility of a substance is to be investigated, or when different metallic oxides which part with their oxygen with difficulty, like the oxides of tin or iron, are to be reduced. But it is not a high temperature only which it is the design of the blowpipe to produce; there are other operations which require a less intense heat, and which, though diametrically opposed to each other, can be effected by the blowpipe. These are, oxidation and reduction.

Oxidation takes place when the assay is heated just before the extreme point of the flame, when all the combustible particles are immediately oxidized. The farther from the point of the (*Turn to next page*).

Use of the Blowpipe—*Continued*

flame, the better the operation goes on, provided the heat be sufficiently intense; and it must be observed that too high a temperature often impedes the oxidation, especially if the assay be supported upon charcoal. Oxidation goes on best at a low red heat. For this purpose the blowpipe-jet must have a large aperture.

Reduction succeeds best with a fine jet, which should not be inserted too far into the flame, since, in this case, a highly illuminating flame is produced, the elements of which, not undergoing complete combustion, do not take oxygen from the assay, which may be considered as being heated in an inflammable gas. If in the course of the operation the assay becomes coated with soot, it is a proof that the flame is too smoky, which diminishes the intensity of the heat. The blue flame was formerly regarded as the proper reducing flame; this is, however, untrue, for it is the brilliant portion of the flame which causes deoxidation, but the assay must be held in it in such a manner as to be surrounded by it on all sides, and protected from the contact of the air. I mention once more that it is the combustible atmosphere which surrounds the assay which effects reduction, and not the charcoal; the reduction which takes place at the points of contact of the assay and the charcoal would take place equally as well in the outer as in the inner flame.

The most important matter is to be able to produce at will oxidation or reduction, which is soon learned by practice. Oxidation is so easily performed that it is only necessary to be told how to do it; reduction requires more practice, and a better knowledge of the management of the flame. It is an excellent plan, if one wishes to practice in making a good reducing flame, to fuse a small grain of tin upon charcoal, and raising it to a white heat, to endeavor to keep its surface brilliant. Tin has so strong an attraction for oxygen, that the moment the flame is changed in the least, the metal becomes covered with an infusible crust of the oxide of tin. One can begin with a very small grain, and gradually increase its size; the larger the quantity of tin which he can keep melted in the metallic state, the more skilful is he in his art.

The Support

Charcoal. The substance to be examined by the blowpipe must rest upon something or be held firmly in some way. The best substance for a support is charcoal. That of mature pine, or soft wood in general, is preferable. The charcoal of the fir often snaps and throws off the assay, while that of hard and compact woods gives so large a quantity of ashes, which often contain a large proportion of iron, that it can only be used in case of necessity. . . .

Platina. In certain cases, in which the reducing action of charcoal might impede the desired reaction, platina may be employed as a support . . . sometimes as a fine wire. . . .

Platina Wire. GAHN, who saw at once the inutility of the platina spoon, but was not acquainted with the use of the foil, contrived another method of using platina as a support, which far surpasses either of the others, and permits us to dispense with the spoon and foil in most cases.

A platina wire is bent into an eye at one end, which eye serves as a support in the following manner. It is moistened by the mouth, and then dipped into the flux, of which a small quantity adheres to it, which, when melted to a bead, remains attached to the eye. The assay is then moistened so that a part of it adheres to the bead, and the two are then subjected together to the action of the flame. The melted mass is then in a position in which it can be conveniently examined; since it is free from the deceptive play of colors, which is often caused on charcoal, by the adherence of the assay to the dark-colored ground.

Glass tubes. In case the assay is to be roasted in such a manner as to detect the substances which may be volatilized in the operation, I make use of a glass tube at least three inches long and one-twelfth of an inch in diameter, open at both ends. The assay is placed in this, near one end, and the tube is to be held with this end slightly inclined downwards. According as more or less heat is required, the spot where the assay lies is to be heated with a spirit-lamp or by the blowpipe flame; and the tube can be inclined more or less as a stronger or lighter draught of air is required. Substances which are volatilized by this operation, but not gaseous, sublime into the upper part of the tube, and can then be recognized. Although straight tubes require no previous preparation, and are therefore easily procured, there is one difficulty attendant on their use, which is, that the assay is apt to fall out if the tube be inclined before it is so softened by the heat that the substance under examination can fasten itself to it. It is, therefore, better to bend the tubes near the lower opening, at an oblique angle. The assay is then to be laid in the angle, and the tube can then be inclined at an angle sufficient to allow the gaseous vapors to rise without danger of its falling out.

Glass matrasses. When the assay is to be examined for water or other volatile matters, or when it is liable to decrepitate, it must be heated in a glass tube closed at one end, and slightly enlarged at the other, so as to have the form of a small matrass, since the volatile matters are more easily driven off when the air is allowed to circulate in the apparatus.

When, on the other hand, combustible substances are to be sublimed from the assay, as sulphur, arsenic, etc., the tube must not be enlarged at the closed end, to avoid combustion, which might be caused by the circulation of air.

The Reagents

Cronstedt used generally but three reagents; basic carbonate of soda, borate of soda and the double salt of the phosphate of soda and ammonia, which I shall call hereafter, for the sake of brevity, by their common technical names, soda, borax and salt of phosphorus. These reagents are all still in use, and among the great number of those which have been tried since that time, not one has been found to replace either of these. It is singular enough that, in the very beginning of the art, the very best reagents should have been hit upon. In addition to these, which are constantly required, others, intended for certain special purposes, are not so often used, but must be at hand, as occasion may require.

Jons Jakob Berzelius was born near Linköping, Sweden, August 20 (or 29th), 1779, and died at Stockholm, August 7, 1848. He received the degree of M. D. from the University of Upsala at the age of 23, and began to teach in the University of Stockholm. In 1814 he published "Theory of Chemical Proportions and the Chemical Action of Electricty." In 1818, at the age of 39, he published the first table of atomic weights, the result of ten years of research. To Berzelius is due in large part our familiar chemical symbols, and the theory of compounds made up of radicles having different electric charges.

FIRST GLANCES AT NEW BOOKS

THE CIPHER OF ROGER BACON—William Romaine Newbold—*Univ. of Penna.* ($4). "MICHITON OLADABAS MULTOS TE TCCR CERC PORTAS." This was the inscription at the end of a cipher manuscript found in a European castle, and which gave Professor Newbold a clue from which he began to decipher it, soon showing that the author was Roger Bacon, thirteenth century English monk and author of the Opus Majus. Prof. Newbold worked on the problem until his death, and in the present posthumous work, edited by his colleague, Prof. Roland G. Kent, he tells what he read in the manuscript, and passes on his methods to others who may tackle it. Among the many startling conclusions drawn are that Bacon had a compound microscope and understood the mechanism of fertilization of the ovum, and that he had a telescope more than 300 years before Galileo, with which he observed a spiral nebulae in Virgo. The history of the manuscript and the methods of decipherment make a really thrilling tale.

General Science
Science News-Letter, May 12, 1928

THE OPUS MAJUS OF ROGER BACON—Robert Belle Burke—*Univ. of Penna.* ($10). Considering the remarkable knowledge displayed in this famous work by the thirteenth century friar, Roger Bacon, it is rather strange that it has never before been translated into English. However, Prof. Burke has now performed that task, and in the pages of these two volumes the modern reader can find the first plea for experimental science and the famous passage that inspired Columbus to sail westward for India. Mathematics, philosophy, optics, the causes of error—all these are treated in surprisingly modern fashion, and in his translation Prof. Burke has admirably succeeded in following the spirit of the original.

General Science
Science News-Letter, May 12, 1928

BOSTON THROUGH THE AGES—Irving B. Crosby—*Marshall Jones Co.* ($2). This geological story of the city in which so much scientific progress has been made will interest every visitor who has time to prowl around the rocks, shore lines, and other ancient evidences of pre-Mayflower times.

Geology
Science News-Letter, May 12, 1928

PRE-HISTORY CHART—A. E. Jenks—*Nystrom.* If you have waded through geology books and volumes on ancient man to make certain the order of prehistoric cultures, or how the ice sheets fitted in with man's development, or the types of stone, bronze, and iron articles made by men in the prehistoric ages—if you have, you will be interested in this colored wall chart that Prof. Jenks, of the University of Minnesota, has designed. The pictures of the types of artifacts of each culture are particularly interesting, because of their large size and the ease with which they may be studied in comparison with one another. The only missing link in this very useful display is a table of dates, but in view of the disagreements on this score, perhaps the anthropologist is justified in merely indicating duration of time by the comparative length of lines on his chart.

Anthropology
Science News-Letter, May 12, 1928

PSYCHOLOGY, ITS FACTS AND PRINCIPLES—H. L. Hollingsworth—*Appleton* ($3). This text will appeal to teachers, students, and general readers in search of a comprehensive psychology that deals with mental processes and leaves nerves and sense organs to another volume. The author does not champion any one of the current brands of psychology. Where there is a diversity of opinion, as in the case of the feelings and emotions, he cites theories and discusses them. The set of projects and exercises to fit each chapter is a valuable feature of the work.

Psychology
Science News-Letter, May 12, 1928

FLATLAND—A Square—*Little, Brown* ($1.50). A new edition of this famous work by the Reverend Doctor Edwin A. Abbott, which, when it first appeared forty years ago, suggested some of the paradoxes of hyper-dimensional geometry that have now become familiar with the popularity of relativity.

Mathematics
Science News-Letter, May 12, 1928

A HISTORY OF RAILWAYS IN IRELAND—J. C. Conroy—*Longmans.* A book which covers the whole history of the Irish railway system from the beginning to the present, and which constitutes the initial volume in a series on Irish economic history.

Economics
Science News-Letter, May 12, 1928

PHYSICS FOR COLLEGE STUDENTS—A. A. Knowlton—*McGraw-Hill* $3.75). Here is a college physics text that is really *different*. Departing from the time-honored division of such a book into formal sections on Mechanics, Light, Heat, etc., the author has chosen to treat the body of physics as a whole. He endeavors to humanize the book by seeking to provide an answer to the "Why should I study physics?" of the student who is not taking it as a preliminary to a technical course. The incorporation into the work of elementary discussions of relativity, the quantum theory, and other aspects of the "new physics" serves to make it representative of present-day physical thought.

Physics
Science News-Letter, May 12, 1928

ELEMENTS OF OPTICS — Joseph Valasek—*McGraw-Hill* ($2). An elementary text-book that takes full advantage of the many interesting things in optical science. Intended for college students, so knowledge of mechanics, and a little mathematics, is assumed.

Physics
Science News-Letter, May 12, 1928

THE CHEMISTRY OF LEATHER MANUFACTURE—John Arthur Wilson—*Chemical Catalog* ($10). This book brings the assistance of modern chemical and micrological science to the assistance of one of the oldest, and therefore one of the most empirically conducted, of the arts. It belongs on the reference shelves not only of chemical laboratories and technological schools, but on the desks of all really properly equipped directors of large tanning and leatherworking plants.

Chemical Technology
Science News-Letter, May 12, 1928

SELECTIVE FERTILIZATION—Donald Forsha Jones—*University of Chicago Press* ($2). This small book sets forth the results of a series of important researches on the cross-pollenation of plants. It will be needed as a reference by all plant breeders.

Botany
Science News-Letter, May 12, 1928

THE ELEMENTS OF ECONOMIC GEOLOGY—J. W. Gregory—*Dutton* ($3.25). A compact and well-gotten-up textbook.

Geology
Science News-Letter, May 12, 1928

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SNAPSHOTS OF SCIENCE

By E. E. SLOSSON

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